

CLAIMS

We claim:

1. A process for making of nickel hydroxide comprising:

providing at least one enclosed reactor containing nickel metal;

5 introducing sulfuric acid at a first pressure into each of said at least one reactor to dissolve said nickel metal;

introducing oxygen containing gas into the process at a second pressure above the first pressure;

producing a nickel sulfate solution;

10 collecting the nickel sulfate solution; and

converting the nickel sulfate solution to nickel hydroxide.

2. The process of claim 1, further comprising adding sulfuric acid continuously to

maintain stoichiometry within each of said at least one reactor until all of said nickel

15 metal is dissolved.

3. The process of claim 1, wherein said first pressure comprises a range of about 10

psi to about 149 psi.

20 4. The process of claim 1, wherein said second pressure comprises a range of about

11 to about 150 psi.

5. The process of claim 1, wherein the nickel metal comprises nickel pellets having a diameter of at least .1 mm.

6. The process of Claim 1, said converting said nickel sulfate solution comprising:
5 separating nickel sulfate from said nickel sulfate solution; and
converting the nickel sulfate to nickel hydroxide.

7. The process of claim 6, said separating comprising heating the nickel sulfate solution until water evaporates.

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8. The process of claim 1, said at least one reactor comprising more than one reactor having a first reactor and a last reactor, wherein said reactors are connected in series between a pump and a sulfuric acid container.

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9. The process of claim 8, said introducing oxygen containing gas comprises introducing oxygen containing gas between the pump and the first reactor.

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10. The process of claim 1, said at least one reactor comprising one reactor column, wherein said one reactor column is connected between a pump and a sulfuric acid container.

11. The process of claim 10, said introducing oxygen containing gas comprises introducing oxygen containing gas between the pump and one reactor column.

12. The process of claim 1, said sulfuric acid having a concentration sufficient to dissolve said nickel metal.

5 13. The process of claim 1, said sulfuric acid having a concentration of about 7% to about 30%.

14. The process of claim 10, said collecting comprising depositing the nickel sulfate solution into said sulfuric acid container.

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15. The process of claim 1, wherein the second pressure is at least 2 psi greater than the first pressure.

16. The process of Claim 1, said introducing oxygen containing gas comprising
15 introducing oxygen containing gas into a head space of said at least one reactor.

17. The process of Claim 1, further comprising heating said nickel sulfate solution during said introducing said sulfuric acid and introducing said oxygen containing gas.

20 18. The process of Claim 19, said heating comprising heating said at least one reactor to a temperature between 90° to 95°C.

19. The process of Claim 10, said introducing oxygen containing gas comprising introducing oxygen containing gas between said one reactor and the sulfuric acid container.

5 20. The process of Claim 8, said introducing oxygen containing gas comprising introducing oxygen containing gas between the last reactor and the sulfuric acid container.

21. A process for converting bulk nickel metal to nickel sulfate comprising:
10 providing at least one enclosed reactor column containing bulk nickel metal, said bulk nickel metal having an average size of at least .1 mm;
introducing sulfuric acid at a first pressure into each of said at least one enclosed reactor column, said sulfuric acid having a concentration sufficient to dissolve the bulk nickel metal;
15 introducing oxygen containing gas at a second pressure above the first pressure to produce a nickel sulfate solution;
collecting the nickel sulfate solution; and
separating the nickel sulfate from the nickel sulfate solution.

20 22. The process of claim 21, said introducing sulfuric acid comprising a pump pumping sulfuric acid to each of said at least one reactor column from a sulfuric acid container.

23. The process of claim 22, said introducing sulfuric acid comprising a pump pumping sulfuric acid to a first reactor column from a sulfuric acid container, said first reactor connected in series to at least one further reactor column comprising at least a last reactor column, said last reactor column adapted to flow the nickel sulfate solution to the 5 sulfuric acid container for said collecting.

24. The process of claim 23, further comprising adding sulfuric acid continuously to maintain stoichiometry within each of said at least one enclosed reactor column until all of said nickel metal is dissolved.

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25. The process of claim 21, wherein said first pressure is in the range of about 10 psi to about 149 psi.

26. The process of claim 21, wherein the pressure of said first pressure in a range of 15 about 11 to about 150 psi.

27. The process of claim 21, wherein the second pressure is at least 2 psi greater than said first pressure.

20 28. The process of claim 21, said separating comprising heating the nickel sulfate solution until nickel sulfate precipitates.

29. The process of claim 21, said at least one reactor column comprising four reactor columns, wherein said four reactor columns are connected in series between a pump and a sulfuric acid container.

5 30. The process of claim 29, said introducing oxygen containing gas comprises introducing oxygen containing gas between the pump and the first of said four reactor columns.

10 31. The process of claim 21 said at least one reactor column comprising one reactor column, wherein said one reactor column is connected between a pump and a sulfuric acid container.

15 32. The process of claim 31, said introducing oxygen containing gas comprising introducing oxygen containing gas between the pump and the one reactor column.

33. The process of claim 21, said sulfuric acid having a concentration of about 7% to about 30%.

20 34. The process of claim 21, said collecting comprising depositing the nickel sulfate solution into said sulfuric acid container.

35. The process of Claim 21, further comprising heating said nickel sulfate solution during said introducing said sulfuric acid and introducing said oxygen containing gas.

36. The process of Claim 35, said heating comprising heating said nickel sulfate solution to a temperature between 90 °C to 95 °C.

5 37. The process of Claim 29, said introducing oxygen containing gas comprising introducing oxygen containing gas between the last of said four reactor columns and the sulfuric acid container.

10 38. The process of Claim 31, said introducing oxygen containing gas comprising introducing oxygen containing gas between said one reactor and the sulfuric acid container.

15 39. The process of Claim 1, said oxygen containing gas comprising oxygen gas, air or a mixture thereof.

40. The process of Claim 21, said oxygen containing gas comprising oxygen gas, air or a mixture thereof.